ISSN 1809-127X (online edition)
© 2010 Check List and Authors
Open Access | Freely available at *www.checklist.org.br*

Check List
Journal of species lists and distribution

LISTS OF SPECIES

Amblypygi, Opiliones, Schizomida, Scorpiones and Chilopoda, Tocantins, Brazil

Adriano B. Kury [1*], Amazonas Chagas-Jr [1], Alessandro P.L. Giupponi [1] and Abel Pérez González [2]

1 Museu Nacional, Universidade Federal do Rio de Janeiro, Departamento de Invertebrados. Quinta da Boa Vista, São Cristóvão. CEP 20940-040. Rio de Janeiro, RJ, Brazil
2 Universidade Federal do Rio de Janeiro, Núcleo em Ecologia e Desenvolvimento Sócio-Ambiental de Macaé. Caixa Postal 119331. CEP 27910-970. Macaé, R J, Brazil
* Corresponding author. E-mail: *adrianok@gmail.com*

ABSTRACT: The Tocantins 2007 Expedition of the Project "Aracnídeos e Miriápodes da Mata Atlântica" (AMMA) produced many new records of arachnids and centipedes, with 61 morphotypes identified. Among the results are: OPILIONES: 30 morphotypes with six new records of families and one of subfamily from Tocantins state; discovery of two undescribed species of *Roquettea* Mello-Leitão, 1931; *Saramacia alvarengai* Kury, 1997 is newly considered a junior subjective synonym of *Saramacia annulata* (Mello-Leitão, 1931); *Brotasus* Roewer, 1928 is transferred to Escadabiidae; the gonyleptid genera *Parapachyloides* Roewer, 1913 and *Schubartesia* B. Soares, 1944 are transferred to Gonyleptinae; SCHIZOMIDA: one species, new record of the order from Tocantins and from the Cerrado biome; SCORPIONES: seven species, one of them new record from Tocantins and two morphotypes; Chilopoda: 19 morphotypes, SCUTIGEROMORPHA: a widespread species *Sphendononema guildingii* (Newport, 1845) and another morphotype; GEOPHILOMORPHA: one morphotype; SCOLOPENDROMORPHA: 16 morphotypes, seven of them new records.

INTRODUCTION

The state of Tocantins has been only recently (1988) dismembered from Goiás. Its capital city, Palmas, has been founded only in 1989, contrasting to most other Brazilian capitals, which date from Portuguese colonial period. Sampling of terrestrial arthropods has traditionally been made in a casual and eventual fashion with only summary records for most taxa. Many pre-1988 records mention only "Goiás", without detail of locality (*e.g.* Bücherl 1939). It is possible that some of them may refer to Tocantins State, but this is uncertain. Plant covering in the natural formations of the state mark a transition between Amazonian rainforest and northeastern Cerrado.

Records Arachnida and Chilopoda from Tocantins are scarce in the literature, and the present work constitutes the first arachnological survey focused specifically in this state. The only previous know faunistical survey that includes information about arachnids from Tocantins is the list of Araneae and Scorpiones from the Cerrado biome that were treated by Motta and Bertani (2010). This scenario make the compilation of arachnofauna of Tocantins a hard work, since the immense majority of the records need to be rescued from isolated records or descriptions of genera and species in the wide and disperse arachnological bibliography (*e.g.*, ARANEAE: Theraphosidae: Schmidt 2004; Guadanucci *et al.* 2007; Araneidae: Levi 1985; 1988; 1996; 1996; 2007, Corinnidae: Bonaldo and Brescovit 2005; Souza and Bonaldo 2007, Ctenidae: Polotow and Brescovit 2009, Pholcidae: Mello-Leitão, 1944, Palpimanidae: Buckup and Ott 2004, Salticidae: Ruiz and Brescovit 2005; 2006, Scytodidae: Rheims and Brescovit 2000; 2006; 2007, Sicariidae: Martins *et al.* 2002, Trechaleidae: Carico 2008; Carico and Silva 2010; Silva and Lise 2010, Zodariidae: Candiani *et al.* 2008; Lise *et al.* 2009). Even for one of the most studied arachnid orders such as Araneae, only a total of 44 species were previously recorded from Tocantins (A. Santos, pers. comm., 2010) clearly reflecting the panorama of the very poorly known arachnological biodiversity in this region of central Brazil. Reinforcing this picture, there is no published record of Solifugae, Palpigradi, Pseudoscorpiones, Ricinulei and Thelyphonida from Tocantins.

The available literature on the centipedes from Tocantins is limited to descriptions of new species (Chamberlin 1958) or new records, without specific identification, in annals of congresses. So far three species and two undescribed morphotypes of Chilopoda were recorded to Tocantins as follows – one Scutigeromorpha (*Pselliodes subglaber* Chamberlin, 1958 = *S. guildingii*), one Lithobiomorpha (Henicopidae), one Geophilomorpha (Geophilidae), and two Scolopendromorpha (*Rhoda isolata* Chamberlin, 1958 and *Scolopendropsis duplicata* Chagas-Jr., Edgecombe and Minelli, 2008).

As part of the Project "Aracnídeos e Miriápodes da Mata Atlântica" (AMMA), the ARACNOLAB (Laboratory of arachnids of the Museu Nacional/UFRJ) made an expedition to Tocantins in June 2007, aiming to survey chilopods and minor arachnid orders and obtain more specimens of a remarkable scolopendromorph, *Scolopendropsis duplicata* Chagas-Jr., Edgecombe and Minelli 2008, that was previously sent to our lab and later described by one of us (Chagas-Jr. *et al.* 2008). The objective of the present work is to offer a preliminary and general overview of the results of "Tocantins 2007 expedition" that yielded a great number of morphotypes of many unrecorded orders and families and constitutes the greatest survey of Arachnida and Chilopoda ever made in the Tocantins state.

Materials and Methods

Samples studied come from four sources: Museu Nacional/UFRJ, Rio de Janeiro (MNRJ, mostly Tocantins 2007 Expedition of Project AMMA, collecting of terrestrial arthropods in Tocantins has been made under license: 11166-1 SISBIO-IBAMA), loan from Instituto Butantan, São Paulo (IBSP, curator: Antonio D. Brescovit), loan from Departamento de Zoologia da Universidade de Brasília (DZUB, curator: Paulo C. Motta), and literature. Also some specimens from Senckenberg Museum, Frankfurt (SMF, curator: Peter Jäger) have been studied for comparison.

Localities sampled in Tocantins are represented on a map (Figure 1) and detailed in Table 1 and to each is give a locality ID number, which is also used in the list of species. Taxonomic IDs of the Arachnida (orders Amblypygi, Opiliones, Schizomida, Scorpiones) and Chilopoda (orders Geophilomorpha, Scolopendromorpha and Scutigeromorpha) are given in the results section, with information on the status of the records (if new for Tocantins and how far from previous records). Vouchers are identified by collection numbers, a plus sign (+) indicates more than one lot is available. Coordinates extrapolated from literature data are given only down to minutes.

Standard abbreviations of Brazilian states cited are: AP (Amapá), BA (Bahia), ES (Espírito Santo), GO (Goiás), MS (Mato Grosso do Sul), MT (Mato Grosso), PA (Pará), PE (Pernambuco), PI (Piauí), RJ (Rio de Janeiro), SP (São Paulo) and TO (Tocantins).

Table 1. List of localities of state of Tocantins sampled for arachnids and chilopods.

Loc ID	Municipality	Locality	Lat.	Long.	Source	Remark
1	Araguaína	Araguaína	7°11' S	48°12' W	DZUB	Loan
2	Dianópolis	Dianópolis	11°38' S	46°48' W	DZUB	Loan
3	Lagoa da Confusão	hill around the Gruta da Igreja	10°49'24.43" S	49°37'10.35" W	Project AMMA	
4	Lagoa da Confusão	inside Gruta da Igreja cave	10°49'18.70" S	49°37'11.19" W	Project AMMA	
5	Lajeado	Fazenda Capão Grande	9°45'34.44" S	48°19'57.09" W	Project AMMA	
6	Lajeado	Parque Estadual do Lajeado	10°10'29.85" S	48°10'40.01"W	Project AMMA	
7	Mateiros	Parque Estadual do Jalapão	10°36'9.35" S	46°39'41.70" W	Project AMMA	different collecting points
8	Novo Jardim	Novo Jardim, cave	11°49' S	46°37' W	DZUB	Loan
9	Peixe	Peixe	12°1' S	48°32' W	MNRJ donation	
10	Formoso do Araguaia	Ilha do Bananal	11°51' S	49°35' W	M-L (1933; 1936; 1939)	material partly lost
11	Porto Nacional	Luzimangue	10° 5'53.78" S	48°27'30.66" W	Project AMMA; MNRJ (donation USP)	
12	Taquaruçu	Cachoeira do Anésio	10°18'38.83" S	48° 9'51.61" W	Project AMMA	
13	Taquaruçu	Pousada Lokau, peridomiciliar	10°19'10.01" S	48° 9'14.96" W	Project AMMA	
14	Taquaruçu	Vai Quem Quer	10°23'39.28" S	48° 7'56.41" W	Project AMMA	
15	Palmas	Palmas	10°10' S	48°19' W	DZUB	Loan

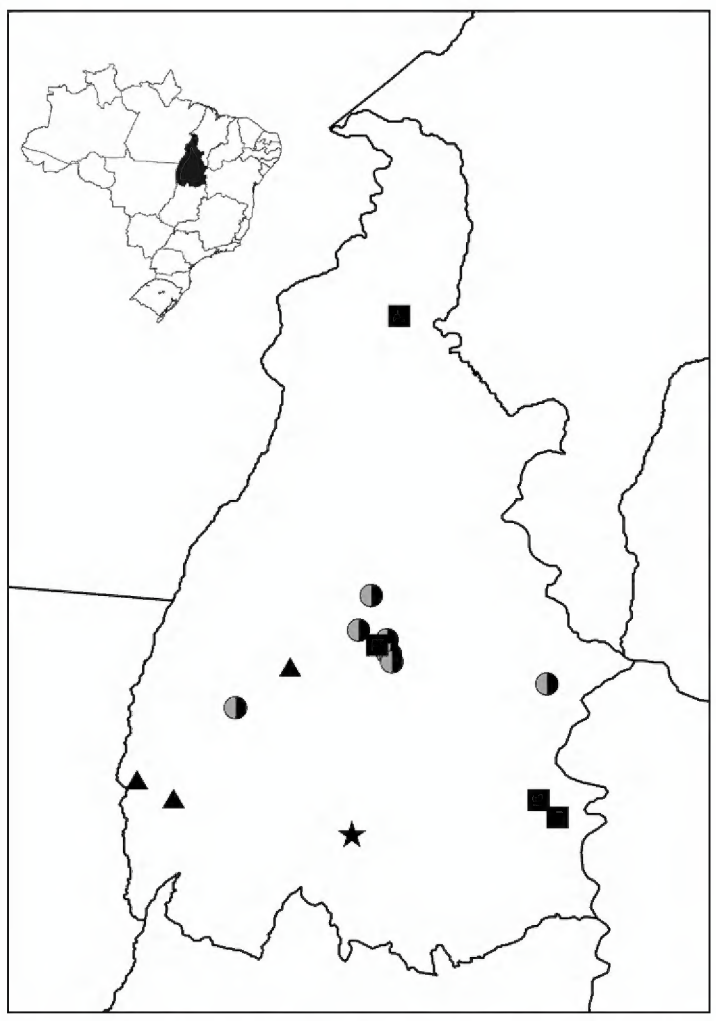

Figure 1. Map showing the localities sampled for Arachnida and Myriapoda in Tocantins. Data from literature = triangles; Project AMMA = circle; loans = square and donation = star.

Results and Discussion

1. Order Amblypygi Thorell, 1883

The first record of the order from Tocantins is in a survey of cave fauna which appeared in 2007 in the proceedings of a congress, but they did not specify any family. Two years later, a *Charinus* sp. and *Heterophrynus longicornis* were recorded, also from caves and in congress proceedings as well. Our own collecting yielded two morphotypes: 1) a possibly undescribed *Charinus*, genus widespread in Brazil, with numerous unpublished records, known from BA and PA (unpublished) and previously recorded from TO and 2) *Heterophrynus longicornis*, a common species known from center-northern-northeastern Brazil (Giupponi 2002) and previously recorded from TO.

Charinidae, *Charinus* sp 1 – (MNRJ 09185, loc 11).

Phrynidae, *Heterophrynus longicornis* (Butler, 1873) – (MNRJ 09144, loc 3; MNRJ 09150, loc 4; MNRJ 09145, loc 5; MNRJ 09142, loc 6; MNRJ 09147, loc 7; MNRJ 09146, loc 11; MNRJ 09143, loc 14).

2. Order Opiliones Sundevall, 1833

The knowledge of Opiliones from Tocantins was hitherto restricted to two species described by Mello-Leitão: *Ypsilonurus mutilatus* Mello-Leitão, 1933

(Gonyleptidae – Gonyleptinae) from Ilha do Bananal and *Corderobunus vittatus* Mello-Leitão 1939 (Sclerosomatidae – Gagrellinae) from the same locality. An explanation is in order here, as Portuguese language is not so widely known (our translation): Roewer (1953) mistakenly cited the latter species as from Xingú, misled by the title of Mello-Leitão's (1939) paper "Opiliones collected in Xingú by Dr. Henry Leonardos". Actually, the description of *C. vittatus* entered as a bonus in the end of the text "Likewise, material collected in the Bananal Island came to my hands and is described below".

Some species of Opiliones described from localities such as Bagagem and Cametá, in the Pará state (Kury 2003), western bank of Tocantins river, may also occur in Tocantins state (eastern bank). These are: *Cynorta conspersa* (Perty, 1833), *Paecilaema triseriatum* Roewer, 1947, *Gryne leprosa* Sørensen, 1932, *Gryne orensis* (Sørensen, 1879), *Roquettea singularis* Mello-Leitão, 1931, *Syncranaus cribrum* Roewer, 1913, *Protimesius laevis* (Sørensen, 1932), *Stygnus luteus* (Mello-Leitão, 1931) and *Stygnus tocantinensis* Pinto-da-Rocha, 1997. However, *Ampheres tocantinus* Roewer, 1943, *Carlotta serratipes* Roewer, 1943 and *Graphinotus magnificus* (Roewer, 1943), represent a collective labeling error, these three species are from the Atlantic Forest in Espírito Santo state.

The Expedition Tocantins 2007 yielded 30 morphotypes of Opiliones, but none of the two previously known species. As expected, the affinities are mixed between Amazonian (forest formations) and NE Brazil (open formations). The morphotypes are listed below under each family.

2.1. Cosmetidae C.L. Koch, 1839

A total of 9 morphotypes of this family have been retrieved from Tocantins, representing new records of the family from Tocantins state. Only one of these – *Bodunius biocellatus* Mello-Leitão, 1935 – has been recognized as a described species, previously known from GO state. Two other represent species of *Roquettea* which have been recently described by Ferreira and Kury (2010). The genus *Roquettea* is also known from AP and PA. *Acantholibitia* Mello-Leitão, 1928 is closely related to *Bodunius* and formally known from MS and MT. *Cynorta* Koch, 1839 is an artificial genus with more than 100 species in South America. *Eucynortella* Roewer, 1912 occurs in Central and South America. In Brazil known from AM and MT. *Eupoecilaema* Roewer, 1917 occurs in Central and South America. In Brazil known from AM, GO, PA and SP.

Cosmetidae, *Acantholibitia* sp 1 – (MNRJ 19082, loc 7).

Cosmetidae, *Bodunius biocellatus* Mello-Leitão, 1935 – (MNRJ 18973+, loc 3).

Cosmetidae, *Cynorta* sp 1 – (MNRJ 19008, loc 5).

Cosmetidae, *Cynorta* sp 2 – (MNRJ 19015, loc 11).

Cosmetidae, *Eucynortella* sp 1 – (MNRJ 18980, loc 3; MNRJ 18970, loc 4).

Cosmetidae, *Eupoecilaema* sp 1 – (MNRJ 19048+, loc 7).

Cosmetidae, *Eupoecilaema* sp 2 – (MNRJ 18978+, loc 5; MNRJ 19068, loc 6; MNRJ 19053+, loc 7; MNRJ 18968, loc 14).

Cosmetidae, *Roquettea jalapensis* Ferreira and Kury, 2010 – (MNRJ 19046, loc 7).

Cosmetidae, *Roquettea taurina* Ferreira and Kury, 2010 – (MNRJ 18966, loc 14).

2.2. Escadabiidae Kury and Pérez, 2003

These are small Opiliones found in the leaf litter. Only two morphotypes of this family have been retrieved from Tocantins (new record of family Escadabiidae from TO), all belonging to undescribed species of genus *Brotasus* Roewer, 1928, previously known only from the Cerrado in SP. This genus has been originally described in Phalangodidae, and regarded as Grassatores incertae sedis (Kury 2003), but examination of type material (2 ♂ 1 ♀ syntypes, SMF RII 103/29) of the type species, *Brotasus megalobunus* Roewer, 1928, including male genitalia, proves that morphology matches Escadabiidae as defined in Kury and Pérez (2007). This is a new family assignment.

Escadabiidae, *Brotasus* sp 1 – (MNRJ 19093, loc 12; MNRJ 19094, loc 14).

Escadabiidae, *Brotasus* sp 2 – (MNRJ 19095, loc 5; MNRJ 19096, loc 6).

2.3. Gonyleptidae Sundevall, 1833

A total of six morphotypes is present in our samples, all belonging to the largest subfamilies, Gonyleptinae and Pachylinae, the latter hitherto unrecorded from Tocantins. two of them representing described species from neighbor regions. The large genera *Discocyrtus* Holmberg, 1878 and *Eusarcus* Perty, 1833 are represented with two species each. These genera are widespread in Brazil. *Discocyrtus* has 80+ species mainly in Atlantic Forest, but also MT and cave in BA, *Eusarcus* has 30+ species mainly in Atlantic Forest, also in Argentina and Paraguay. *Parapachyloides* Roewer, 1913 is a genus with two species from the South American semi arid diagonal (one northeastern in Caatinga, Cerrado, and another southwestern in Pantanal and Chaco). Its presence in TO is nothing exceptional. *Schubartesia* B. Soares, 1944 is a monotypic genus, its single species, *Schubartesia singularis* B. Soares, 1944, was hitherto known only from a single locality in western Bahia. It is now recorded from Dianópolis, extreme eastern Tocantins. *S. singularis* was described from the region known as "Os Gerais" and more specifically from the Rio Branco Valley, which is extreme western Bahia, adjacent to Tocantins. There is no waypoint in the literature for this, but we assume it to be in the lower course where Rio Branco meets Rio das Balsas, both converging into the Rio Grande, close to the state Highway BA-458 where there is still natural vegetation (11°37' S, 45°26' W). This would place the new record from Tocantins at most 150 km from the type locality. *Parapachyloides* and *Schubartesia* are large Opiliones, probably closely related between them and also to *Ypsilonurus* (Mello-Leitão, 1933). They have been originally placed in Pachylinae by the artificial Roewerian system, but their morphology, specially genital features matches the definition of Gonyleptinae Kury (1992). They are here accordingly transferred to Gonyleptinae.

Gonyleptidae, Gonyleptinae, *Parapachyloides armatus* (Mello-Leitão, 1931) – (MNRJ 18958, loc 6).

Gonyleptidae, Gonyleptinae, *Schubartesia singularis* B. Soares, 1944 – (DZUB, loc 2).

Gonyleptidae, Pachylinae, *Discocyrtus* sp 1 – (MNRJ

18957+, loc 6; MNRJ 19084, loc 12; MNRJ 19050, loc 14).

Gonyleptidae, Pachylinae, *Discocyrtus* sp 2 – (MNRJ 18977, loc 5).

Gonyleptidae, Pachylinae, *Eusarcus* sp 1 – (MNRJ 19055, loc 4).

Gonyleptidae, Pachylinae, *Eusarcus* sp 2 – (MNRJ 05009, loc 9).

2.4. Manaosbiidae Roewer, 1943

Only one species of Manaosbiidae has been found in our expedition. It allowed a reevaluation of the status of two closely related species of *Saramacia* Roewer, 1913. *Saramacia* consists of four species of dark-colored, large Manaosbiidae sometimes with a yellow stripe on the sides of dorsal scutum. They are distributed in Suriname and Brazil (Amazonas, Mato Grosso, Mato Grosso do Sul, Pará).

Kury (1997) recognized a species in Pará — *Saramacia annulata* (M-L, 1931) and one in Mato Grosso/Mato Grosso do Sul — *Saramacia alvarengai* Kury, 1997, separated by subtle variations in tuberculation of legs and chelicera. Genitalia of species of *Saramacia* is rather uniform, those of *S. annulata* and *S. alvarengai* as illustrated by Kury (1997, pp. 18–19) are essentially the same, differing only in the number of macrosetae in the distal cluster of ventral plate. The present finding of material of *Saramacia* in Tocantins offers samples of a population that bridges the gap between those two. As a result, we consider all *Saramacia* from Pará, Tocantins, Mato Grosso and Mato Grosso do Sul to belong to a single polymorphic species. Species range is now extended to the East. Present record lies around 950-1,500 km from each of the previews records. Formal synonymy is as follows:

Saramacia annulata (Mello-Leitão, 1931).

Rhopalocranoides annulatus Mello-Leitão, 1931d: 118 (♂ holotype MNRJ 11388, examined).

Saramacia annulata: Kury, 2003: 210 (see exhaustive synonymy).

Saramacia alvarengai Kury, 1997a: 6, figs 2-13 (type MNRJ 5328, ♂ holotype, 5 ♀ paratypes; MNRJ 6241, 1 ♀ paratype; MNRJ 5327, 2 ♀ paratypes, examined). New Synonymy.

Distribution: BRAZIL. Mato Grosso state: Chapada dos Guimarães. Mato Grosso do Sul state: Nioaque. Pará state: Belém and neighborhood. Tocantins state: Taquaruçu (new record).

Manaosbiidae, *Saramacia annulata* (Mello-Leitão, 1931) – (MNRJ 18969, loc 12).

2.5. Samoidae Sørensen, 1886

Only two morphotypes have been retrieved by this expedition. The family is known from Pacific Islands and Neotropics, but their taxonomy is still unsatisfactory (Pérez and Kury 2007).

Samoidae, Gen. sp 1 – (MNRJ 19087, loc 3).

Samoidae, Gen. sp 2 – (MNRJ 19097, loc 14).

2.6. Sclerosomatidae Simon, 1879

The single subfamily of Sclerosomatidae with Neotropical representatives is the Gagrellinae. The three gagrelline morphotypes present in our samples could not be identified to genus level because of the poor state of the taxonomy of this group in Tocantins or in northern South America.

Sclerosomatidae, Gagrellinae, Gen. sp 1 – (MNRJ 19073, loc 14).

Sclerosomatidae, Gagrellinae, Gen. sp 2 – (MNRJ 18993, loc 5; MNRJ 18975, loc 6).

Sclerosomatidae, Gagrellinae, Gen. sp 3 – (MNRJ 19076, loc 7).

2.7. Stygnidae Simon, 1879

Of this family, four already described species were found. The genus *Protimesius* Roewer, 1913 consists of 18 species of large square-bodied stygnids which long legs and pedipalps. They are distributed from central-western (Mato Grosso), northeastern (Bahia, Maranhão, Paraíba) and northern Brazil (Acre, Amapá, Amazonas, Pará, Rondônia) to the Peruvian Amazonian region, French Guiana and Suriname (Kury 2003; Villarreal and Pinto-da-Rocha 2006; Kury and Pinto-da-Rocha 2008; Pinto-da-Rocha and Villarreal 2009). There is a recently described species from Espírito Santo state (Kury and Pinto-da-Rocha 2008). *Protimesius evelineae* (Soares and Soares 1978) was already recorded from Pará, Maranhão and Paraíba, so the new record from Tocantins merely fills a gap and does not represent any extension of the range of the species.

The genus *Sickesia* H. Soares, 1979 consists of three species of small, oval, short-legged Stygnidae distributed in Mato Grosso, Pará and Piauí (Kury 2003; Pinto-da-Rocha and Carvalho 2009). The new record of *Sickesia usta* (Mello-Leitão, 1941) from Tocantins extends the range of the species to the East.

The genus *Stygnus* Perty, 1833 consists of 20 species of middle-sized oval Stygnidae, distributed in Bolivia, Brazil (Amazonas, Bahia, Goiás, Mato Grosso, Mato Grosso do Sul, Pará, Paraíba, Pernambuco, Rondônia, Roraima, São Paulo), Colombia, Ecuador, French Guyana, Peru, Suriname, Venezuela (Kury 2003). *Stygnus luteus* (Mello-Leitão, 1931) was known from Amapá, Mato Grosso and Pará, the new record from Tocantins extends the species range to the East. *Stygnus multispinosus* (Piza, 1938) was known from Goiás, Mato Grosso, Mato Grosso do Sul, Pará and São Paulo. The new record from Tocantins extends the species range to the Northeast.

Stygnidae, Stygninae, *Protimesius evelineae* (Soares and Soares, 1978) – (MNRJ 18961+, loc 6).

Stygnidae, Stygninae, *Sickesia usta* (Mello-Leitão, 1941) – (MNRJ 19065, loc 5; MNRJ 18960+, loc 6; MNRJ 19047+, loc 7; MNRJ 19056, loc 13; MNRJ 18965+, loc 14).

Stygnidae, Stygninae, *Stygnus luteus* (Mello-Leitão, 1931) – (MNRJ 19058, loc 13; MNRJ 19045, loc 14).

Stygnidae, Stygninae, *Stygnus multispinosus* (Piza, 1938) – (MNRJ 18959, loc 6).

2.8. Zalmoxidae Sørensen, 1886

This family is distributed in Neotropics, SE Asia and Pacific Islands. In Brazil there is a number of species scattered in many states, but their taxonomy is inadequately known. Our 2007 Tocantins Expedition retrieved three unidentified morphotypes.

Zalmoxidae, Gen. sp 1 – (MNRJ 19086, loc 5).

Zalmoxidae, Gen. sp 2 – (MNRJ 19090, loc 14).
Zalmoxidae, Gen. sp 3 – (MNRJ 19091, loc 3).

3. Order Schizomida Petrunkevitch, 1945

The single species identified from our expedition is *Stenochrus portoricensis* Chamberlin, 1922, which is naturally occurring in Mexico and the Caribbean and introduced to many countries. In Brazil it is known from BA, RJ and SP (Tourinho and Kury 1999; Santos *et al.* 2008). This is the first record of the order from Tocantins state and also the first record of Schizomida from the Cerrado biome.

Hubbardiidae, *Stenochrus portoricensis* Chamberlin, 1922 – (MNRJ 04263, loc 13).

4. Order Scorpiones C. L. Koch, 1837

Three families of Scorpiones with 7 morphotypes are represented in our samples, all of them consistent with previously known distribution of the considered species, as in Lourenço (2002).

4.1. Bothriuridae Simon, 1880

One species, *Bothriurus cerradoensis* Lourenço *et al.*, 2004, originally described from Tocantins, our record is close from the type locality. A second species of *Bothriurus* was recorded from Tocantins by Motta and Bertani (2010).

Bothriuridae, *Bothriurus cerradoensis* Lourenço *et al.*, 2004 – (DZUB 2548, loc 7).

4.2. Buthidae C. L. Koch, 1837

Expedition AMMA Tocantins 2007 yielded seven morphotypes. Two species of *Ananteris* Thorell, 1891, already known from Tocantins – *Ananteris balzanii* Thorell, 1891 and *Ananteris mariaterezae* Lourenço, 1982. One species of *Rhopalurus* Thorell, 1876 – *Rhopalurus agamemnon* (C.L. Koch, 1839) (known from BA, GO, PE, PI and only recently recorded from TO by Motta and Bertani 2010). The large genus *Tityus* C.L. Koch, 1836 was so far represented in Tocantins (respectively Bertani *et al.* 2005 and Motta and Bertani 2010) by two species not found in our sampling – *T.* (*Tityus*) *confluens confluens* Borelli, 1901 and *T. (Archaeotityus) mattogrosensis* Borelli, 1899. We collected four morphotypes, of which two are determined only down to subgenus, all of them are new records (one emended record) for Tocantins: *Tityus* (*Archaeotityus*) *maranhensis* Lourenço, de Jesus Jr. and Limeira de Oliveira, 2006 (recorded from MA), *Tityus* (*Tityus*) *blaseri* Mello-Leitão, 1931 (actually already recorded from Tocantins, Mateiros: Jalapão by Motta and Bertani 2010, but mistakenly referred to "Goiás" instead), and two morphotypes of *Tityus* subgenus *Atreus* (known from Amazonia). None of these is unexpected, because they were already known from neighbor states.

Buthidae, *Ananteris balzanii* Thorell, 1891 – (MNRJ 07544, loc 12; MNRJ 07541, loc 14).

Buthidae, *Ananteris mariaterezae* Lourenço, 1982 – (MNRJ 07543, loc 3; MNRJ 07545, loc 11).

Buthidae, *Rhopalurus agamemnon* (C.L. Koch, 1839) – (MNRJ 07538, loc 7).

Buthidae, *Tityus* (*Archaeotityus*) *maranhensis* Lourenço, de Jesus Jr and Limeira de Oliveira, 2006 – (MNRJ 07542, loc 12).

Buthidae, *Tityus* (*Tityus*) *blaseri* Mello-Leitão, 1931 – (DZUB 2547, 3399, loc 7).

Buthidae, *Tityus* (*Atreus*) sp 1 – (MNRJ 07533, loc 5).

Buthidae, *Tityus* (*Atreus*) sp 2 – (MNRJ 07534, loc 14).

4.3. Hemiscorpiidae Pocock, 1893

One species, already know from Tocantins (Motta and Bertani 2010) and Pará state, near the border of Tocantins. This record pushes a little the distribution of the family eastwards.

Hemiscorpiidae, *Opisthacanthus cayaporum* Vellard, 1932 – (MNRJ 07546, loc 11, Figure 2f).

5. Class Chilopoda Latreille, 1817

The diversity of centipedes for the state of Tocantins was estimated in 19 morphotypes, 10 of them identified to species level and nine undescribed morphotypes. The order Scolopendromorpha, with 16 morphotypes, is the most diverse group among the four orders of Chilopoda known to Tocantins. The other five morphotypes were assigned to Scutigeromorpha (two morphotypes), Geophilomorpha (two morphotypes) and Lithobiomorpha (one morphotype). *Rhoda isolata*, Geophilidae and Henicopidae, respectively Scolopendromorpha, Geophilomorpha and Lithobiomorpha were recorded in the literature. Seven species, *Otostigmus caudatus* Brölemann, 1903, *Rhysida brasiliensis* Kraepelin, 1903, *Scolopendropsis bahiensis* (Brandt, 1841), *Scolopendra viridicornis* Newport, 1844, *Dinocryptops miersii* Newport, 1845, *Newportia brevipes*, and *Scolopocryptops piauhyensis* Chagas, 2004, and a subspecies, *Rhoda calcarata carvalhoi* Bücherl, 1942, all belonging to Scolopendromorpha were recorded for the first time for the state of Tocantins.

The most widespread and abundant species in Tocantins is *S. guildingii* (Newport, 1845), a typical Scutigeromorpha widely distributed in the neotropics, followed by *Otostigmus* sp 1 and *Cryptops* sp1, both Scolopendromorpha. *Sphendenonema guildingii* was found in almost all localities visited by our team, except in two of them. It is a very active species at night and easily found in ravines on the edge of the roads or on trunks of trees in the middle of the forest. Some species such as *Scolopendropsis duplicata*, *Sphendenonema* sp 1, *Otostigmus* sp 2, *Otostigmus* sp 3, *Otostigmus* sp 4, *Newportia* sp 1, and *Newportia* sp 2 have a more restricted distribution and were recorded only to one locality each (see species list).

Besides the taxonomic impediment that hindered the identification of the centipedes to the species level, some peculiarities inherent to the collection of this group, such as loss of structures used in identification of many species of Scolopendromorpha (*e.g.*, ultimate pair of legs) or specimens juveniles, also contributed to a compilation of a list with almost half of the taxa identified to generic level.

Despite the large collection effort conducted by our expedition, knowledge about the centipede fauna from Tocantins is still very limited when compared with the centipede fauna from other Brazilian biomes. For example, the Amazonian biome presents 53 species of centipedes, of which 40 species are endemic (Foddai *et al.* 2002a, b, c; Schileyko, 2002). In Tocantins, which presents a typical

"Cerrado" biome with transition to Amazonian biome in the northern of the state, only *Scolopendropsis duplicata* can be considered endemic. We are still far from a complete list of the centipedes from Tocantins; however, this study represents the biggest contribution on this group to date. New collections in different localities and visits to collections such as Universidade Católica de Goiás, with a higher proportion of terrestrial arthropod fauna from the biome of "Cerrado" will certainly increase this first list.

5.1. Order Geophilomorpha Pocock, 1896

The single genus found by us, *Mecistocephalus* Newport, 1843, has been already recorded from neighbor state of Goiás (Bücherl 1942). Only one species of *Mecistocephalus*, *M. guildingii* Newport, 1843, is known to Brazil (Bonato *et al.* 2009). The morphotype found in Tocantins probably is a *M. guildingii*, however, a reanalysis of the material is needed to confirm this supposition. There are also records to *M. guildingii* from Amazonas (Chamberlin, 1914), Rio Grande do Norte (Bücherl 1942), Mato Grosso (Silvestri 1919) and Rio de Janeiro (Crabill 1959). A record of Geophilidae was published in annals of congress as well.

Mecistocephalidae, *Mecistocephalus*. sp 1 – (MNRJ 15294, loc 3; MNRJ 15323, loc 11; MNRJ 15297, loc 12; MNRJ 15295, loc 13)

5.2. Order Scolopendromorpha Pocock, 1896

5.2.1. Scolopendridae Newport, 1844

Otostigminae Kraepelin, 1903 — in the literature there are some records from "Goiás", none explicitly citing Tocantins. Our expedition retrieved five identifiable morphotypes of *Otostigmus* Porat, 1876, only one of them assignable to a described species, widely distributed in Brazil, and one described species of *Rhysida* Wood, 1862, known from neighbor state of BA and ES.

Scolopendrinae Newport, 1844 — we have identified four morphotypes: (a) two *Scolopendropsis* Brandt, 1841, one recently described endemic from Tocantins (and which possesses an unusual number of legs, see Chagas Jr. *et al.* 2008), and *Scolopendropsis bahiensis* (Brandt, 1841) (recorded from BA, MG, PE), (b) one species of *Rhoda* Meinert, 1886: *Rhoda calcarata carvalhoi* Bücherl, 1941 (previously known from MT); a second species, *Rhoda isolata* Chamberlin, 1958 was recorded by Chamberlin (1958) from "Goiás", Ilha do Bananal, which is properly a record from Tocantins and (c) one *Scolopendra* Linnaeus, 1758 (a species widely distributed in Brazil).

Scolopendridae, Otostigminae, *Otostigmus caudatus* Brölemann, 1902 – (MNRJ 15285, loc 5, MNRJ 15312+, loc 11).

Scolopendridae, Otostigminae, *Otostigmus* sp 1 – (MNRJ 15281, loc 3; MNRJ 15279+, loc 5; MNRJ 15283, loc 6; MNRJ 15280, loc 11; MNRJ 15282+, loc 14).

Scolopendridae, Otostigminae, *Otostigmus* sp 2 – (MNRJ 15277, loc 12).

Scolopendridae, Otostigminae, *Otostigmus* sp 3 – (MNRJ 15276, loc 12).

Scolopendridae, Otostigminae, *Otostigmus* sp 4 – (MNRJ 15284, loc 12).

Scolopendridae, Otostigminae, *Rhysida brasiliensis* (Kraepelin, 1903) – (MNRJ 15285, loc 5, MNRJ 15312+, loc 11).

Scolopendridae, Scolopendrinae, *Rhoda calcarata carvalhoi* Bücherl, 1941 – (MNRJ 15324, loc 11).

Scolopendridae, Scolopendrinae, *Scolopendra viridicornis* Newport, 1844 – (MNRJ 15311+, loc 11).

Scolopendridae, Scolopendrinae, *Scolopendropsis bahiensis* (Brandt, 1841) – (MNRJ 15335, loc 7).

Scolopendridae, Scolopendrinae, *Scolopendropsis duplicata* Chagas-Jr, Minelli and Edgecombe, 2008 – (MNRJ 15258+, loc 11).

5.2.2. Cryptopidae Kohlrausch, 1881

We have found one unidentified species of *Cryptops* Leach, 1815. This genus has numerous species all over the world and eight species are known from Brazil, one of them, *Cryptops goiasus* Chamberlin, 1958 was recorded to Goiânia, about 500 kilometers to the border of the state of Tocantins.

Cryptopidae, *Cryptops* sp 1 – (MNRJ 15287, loc 6; MNRJ 15292, loc 11; MNRJ 15289, loc 12; MNRJ 15296, loc 14).

5.2.3. Scolopocryptopidae Pocock, 1896

Our expedition found five morphotypes, one of each genus *Scolopocryptops* Newport, 1844 (one species, *Scolopocryptops piauhyensis*, recently described from PI) and *Dinocryptops* Crabill, 1953 (the single species of the genus, widely distributed in Brazil) and 3 *Newportia* Gervais, 1847 (one species known from PA and Guyana, two other morphotypes).

Scolopocryptopidae, *Dinocryptops miersii* (Newport, 1845) – (MNRJ 15269, loc 5; MNRJ 15270, loc 12).

Scolopocryptopidae, *Newportia brevipes* Pocock, 1891 – (MNRJ 15322, loc 11).

Scolopocryptopidae, *Newportia* sp 1 – (MNRJ 15290, loc 11).

Scolopocryptopidae, *Newportia* sp 2 – (MNRJ 15291, loc 5).

Scolopocryptopidae, *Scolopocryptops piauhyensis* Chagas-Jr, 2004 – (MNRJ 15272, loc 5; MNRJ 15273, loc 7; MNRJ 15317, loc 11).

5.3. Order Scutigeromorpha Pocock, 1896

The centipede most common and well distributed in Tocantins belongs to the order Scutigeromorpha. We recorded two morphotypes, *S. guildingii*, which is widespread in the Neotropics, with records from many Brazilian states and another unidentified morphotype of the same genus, which we believe may not be conspecific. This order was formally recorded from "Goiás", Ilha do Bananal, which is properly a record from Tocantins by Chamberlin (1958) to a new species named *Pselliodes subglaber* Chamberlin, 1958. This species was recently revised by Würmli (2005) and was considered synonymous under *S. guildingii*.

Pselliodidae, *Sphendononema guildingii* (Newport, 1845) – (MNRJ 15264, loc 3; MNRJ 15262, loc 4; MNRJ 15263, loc 5; MNRJ 15267, loc 6; MNRJ 15260, loc 11; MNRJ 15265, loc 12; MNRJ 15266, loc 14)

Pselliodidae, *Sphendononema* sp 1 – (MNRJ 15261, loc 7).

Figure 2. a. *Heterophrynus longicornis* (Butler, 1873), from Lajeado (loc ID 5); b. *Dinocryptops miersii* (Newport, 1845), from Lajeado (loc ID 5); c. *Tityus* (*Atreus*) sp 1 (*asthenes* group), from Lajeado (loc ID 5); d. *Protimesius evelineae* (Soares and Soares, 1978), from Luzimangue (loc ID 11); e. *Sphendononema guildingii* (Newport, 1845), from Taquaruçu (loc ID 14); f. *Opisthacanthus cayaporum* Vellard, 1932, from Luzimangue (loc ID 11).

Acknowledgments: Project AMMA has been partly financed by CNPq and individual scholarships from CNPq and FAPERJ are also thanked. We are indebted to the following people who offered assistance in the field/paperwork in Tocantins: Mr. Judson (Taquaruçu), Danielle Danaga and Kennedy "Road" A.A. Borges (IBAMA, Palmas), Cassiana Solange Moreira, Marcelo de Oliveira Barbosa and Rinaldo Pinheiro de Farias (NATURATINS) and Marcelo Amaral Maciel (Fazenda Capão Grande, Lageado). We would like to thanks also Prof. Paulo Motta (UNB) and Dr. Antonio Brescovit (IBSP) who loaned Tocantins material, and Adalberto Santos, Antonio Brescovit, Arno Antonio Lise, Cristina Rheims, Erica Helena Buckup, José Paulo Guadanucci, Lincoln Suesdek, Mark Harvey, Paulo Cesar Motta, Rogerio Bertani and Volker Mahnert for information on prior records of arachnids from Tocantins.

Literature Cited

Bertani, R., R. Martins and M.A. Carvalho. 2005. Notes on *Tityus confluens* Borelli, 1899 (Scorpiones: Buthidae) in Brazil. *Zootaxa* 869:1-7.

Bonaldo, A.B. and A.D. Brescovit. 2005. On new species of the neotropical spider genus *Attacobius* Mello-Leitão, 1923 (Araneae, Corinnidae, Corinninae), with a cladistic analysis of the tribe Attacobiini. *Insect Systematics and Evolution* 36: 35-56.

Bücherl, W. 1939. Os quilópodos do Brasil. *Memórias do Instituto Butantan* 13: 49-363.

Bücherl, W. 1942. Catálogo dos quilópodos da zona neotrópica. *Memórias do Instituto Butantan* 15 ("1941"), 251-372.

Candiani, D.F., A.B. Bonaldo and A.D. Brescovit.2008. Sobre o gênero Neotropical Tenedos O. Pickard–Cambridge, 1897 (Araneae, Zodariidae), com a descrição de três espécies novas. *Revista Brasileira de Zoologia* 25(1): 128-138.

Carico, J.E. 2008. Revision of the Neotropical Arboreal Spider Genus *Syntrechalea* (Araneae, Lycosoidea,Trechaleidae). *Journal of Arachnology* 36(1): 118-130.

Carico, J.E. and E.L.C. Silva. 2010. Taxonomic review of the Neotropical spider genus *Paradossenus* (Araneae: Lycosoidea: Trechaleidae: Trechaleinae) with a new erection of the subfamily Trechaleinae and a key to included genera. *Journal of Arachnology* 38: 212-236.

Chagas Jr., A., G.D. Edgecombe and A. Minelli. 2008. Variability in trunk segmentation in the centipede order Scolopendromorpha: a remarkable new species of *Scolopendropsis* Brandt (Chilopoda: Scolopendridae) from Brazil. *Zootaxa* 1888: 36-46.

Chamberlin, R.V. 1914. The Stanford Expedition to Brazil 1911 John C. Branner Director. The Chilopoda of Brazil. *Bulletin of the Museum of Comparative Zoology* 58: 151-221.

Chamberlin, R.V. 1958. Five new South American chilopods. *Proceedings of the Biological Society of Washington* 71: 57-60.

Crabill, R.E. 1959. Notes on *Mecistocephalus* in the Americas, with a redescription of *Mecistocephalus guildingii* Newport (Chilopoda: Geophilomorpha: Mecistocephalidae). *Journal of the Washington Academy of Sciences* 49: 188-192.

Ferreira, C.P. and A.B. Kury. 2010. A review of *Roquettea*, with description of three new Brazilian species and notes on *Gryne* (Opiliones, Cosmetidae, Discosomaticinae). *Zoological Science* 27: 697-708.

Foddai, D., Minelli, A. and L.A. Pereira. 2002. Geophilomorpha; p. 459-474 *In* J. Adis (ed.). *Amazonian Arachnida and Myriapoda*. Sofia: Pensoft Publishers.

Foddai, D., A.A. Schileyko, A. and Minelli, A. 2002. Lithobiomorpha; p. 475-478 *In* J. Adis (ed.). *Amazonian Arachnida and Myriapoda*. Sofia: Pensoft Publishers.

Foddai, D., A. Minelli, M. Würmli, and J. Adis. 2002. Scutigeromorpha; p. 501-503 *In* J. Adis (ed.). *Amazonian Arachnida and Myriapoda*. Sofia: Pensoft Publishers.

Giupponi, A.P.L. 2002. Duas novas sinonímias no gênero *Heterophrynus* Pocock, 1894 (Amblypygi, Phrynidae). *Revista Ibérica de Aracnología* 6: 173-175.

Guadanucci, J.P.L., S.M. Lucas, R.P. Indicatti and F.U. Yamamoto. 2007. Description of *Guyruita* gen. nov. and two new species (Ischnocolinae, Theraphosidae). *Revista Brasileira de Zoologia* 24: 991-996.

Kury, A.B. 1997. The genera *Saramacia* Roewer and *Syncranaus* Roewer, with notes on the status of the Manaosbiidae (Opiliones, Laniatores). *Boletim do Museu Nacional* 374: 1-22.

Kury, A.B. 2003. Annotated catalogue of the Laniatores of the New World (Arachnida, Opiliones). *Revista Ibérica de Aracnología* 1: 1-337.

Kury, A.B. and Pérez-G., A. 2007. Escadabiidae Kury and Pérez, 2003; p. 191-194 *In* R. Pinto-da-Rocha, G. Machado, G. and G. Giribet. (ed.). *Harvestmen: the biology of the Opiliones*. Cambridge and London: Harvard University Press.

Kury, A.B. and R. Pinto-da-Rocha. 2008. First record of Stygnidae for the state of Espírito Santo and description of a new *Protimesius* (Arachnida: Opiliones: Laniatores). *Revista Brasileira de Zoologia* 25(2): 319-322.

Levi, H.W. 1985. The spiny orb-weaver genera *Micrathena* and *Chaetacis* (Araneae: Araneidae). *Bulletin of the Museum of Comparative Zoology*, 150(8): 429-618.

Levi, H.W. 1988. The neotropical orb-weaving spiders of the genus *Alpaida* (Araneae: Araneidae). *Bulletin of the Museum of Comparative Zoology*, 151(7): 365-487.

Levi, H.W. 1995. The neotropical orb-weaver genus *Metazygia* (Araneae: Araneidae). *Bulletin of the Museum of Comparative Zoology*, 154(2): 63-151.

Levi, H.W. 1996. The American orb weavers *Hypognatha*, *Encyosaccus*, *Xylethrus*, *Gasteracantha* and *Enacrosoma* (Araneae, Araneidae). *Bulletin of The Museum of Comparative Zoology* 155: 89-157

Levi, H.W. 2007. The orb weaver genus *Mangora* in South America (Araneae, Araneidae). *Bulletin of the Museum of Comparative Zoology* 159: 1-144.

Lise, A.A., R. Ott and E.N.L. Rodrigues. 2009. On the Neotropical genus *Cybaeodamus* (Araneae, Zodariidae, Storeninae). *Iheringia* (Zool.) 99(3): 259-272.

Lourenço, W.R. 2002. *Scorpions of Brazil*. Paris: Les Éditions de l'If. 306p.

Lourenço, W.R., P.C. Motta, F.S.P. Godoi and J.S. Araújo. 2004. Description of a new species of *Bothriurus* Peters (Scorpiones, Bothriuridae) from the state of Tocantins, Brazil. *Boletín de la Sociedad Entomologica Aragonesa* 34: 69-72.

Martins, R., I. Knysak and R. Bertani. 2002. A new species of *Loxosceles* of the *laeta* group from Brazil (Araneae: Sicariidae). *Zootaxa* 94: 1-6.

Mello-Leitão, C.F. de 1939. Opiliões coligidos pelo Dr. Henry Leonardos no Xingú. *Boletim Biológico*, Rio de Janeiro, (N. Série) 4(3), 352-357.

Mello-Leitão, C.F. de. 1944. Algumas aranhas da região amazônica. *Boletim do Museu Nacional, Rio de Janeiro* (N. Ser. Zool.) 25: 1-12.

Motta, P.C. and R. Bertani. 2010. Registros de aranhas (Araneae: Araneidae, Theraphosidae) e escorpiões (Scorpiones) do Cerrado; p. 149-185. *In* I.R. Diniz, J. Marinho-Filho, R.B. Machado and R. B. Cavalcanti (org.). *Cerrado: conhecimento científico quantitativo como subsídio para ações de conservação*. Brasília: Thesaurus.

Pérez-G., A. and A.B. Kury. 2007. Samoidae Sørensen, 1886; p. 224-226 *In* R. Pinto-da-Rocha, G. Machado and G. Giribet (ed.). *Harvestmen: the biology of the Opiliones*. Cambridge and London: Harvard University Press.

Pinto-da-Rocha, R. and L.S. Carvalho. 2009. A new species of *Sickesia* (Laniatores: Stygnidae: Opiliones) and new records for the state of Piauí, Brazil. *Zoologia* 26(2): 337-342.

Pinto-da-Rocha, R. and O. Villarreal-M. 2009. Cladistic analysis of the Stygninae and description of a new species of *Protimesius* Roewer, 1913 (Opiliones: Stygnidae). *Zootaxa* 2176: 48-56.

Polotow, D. and A.D. Brescovit. 2009. Revision and cladistic analysis of Isoctenus and description of a new neotropical genus (Araneae, Ctenidae, Cteninae). *Zoological Journal of the Linnean Society* 155(3): 583-614

Rheims, C.A. and A.D. Brescovit. 2000. Six new species of *Scytodes* Latreille, 1804 (Araneae, Scytodidae) from Brazil. *Zoosystema* 22(4): 719-730.

Rheims, C.A. and A.D. Brescovit. 2006. Spiders of the genus *Scytodes* Latreille (Araneae: Scytodidae) from Brazilian Cerrado and Caatinga. *Bulletin of the British Arachnological Society* 13: 297-308.

Roewer, C.F. 1953. Neotropische Gagrellinae (Opiliones, Arachnida). (Weitere Weberknechte XVII). *Mitteilungen aus dem Zoologischen Museum in Berlin* 29(1): 180-265.

Ruiz, G.R.S. and A.D. Brescovit. 2005. Three new genera of jumping spider from Brazil (Araneae, Salticidae). *Revista Brasileira de Zoologia* 22(3): 687-695.

Ruiz, G.R.S. and A.D. Brescovit. 2006. *Edilemma*, a new genus of jumping spider from Tocantins, Brazil (Araneae, Salticidae). *Revista Brasileira de Zoologia* 23(2): 364-366.

Santos, A.J., S.C. Dias, A.D. Brescovit and P.P. Santos. 2008. The arachnid order Schizomida in the Brazilian Atlantic Forest: a new species of *Rowlandius* and new records of *Stenochrus portoricensis* (Schizomida: Hubbardiidae). *Zootaxa* 1850: 53-60.

Schileyko, A.A. 2002. Scolopendromorpha; p. 479-500 *In* J. Adis (ed.). *Amazonian Arachnida and Myriapoda*. Sofia: Pensoft Publishers.

Schmidt, G. 2004. Der Doppelgänger von *Acanthoscurria geniculata* (C.L. Koch, 1841) heist *Nhandu chromatus* sp. n. (Araneae: Theraphosidae: Theraphosinae). *Tarantulas of the World* 92: 6-11.

Silva, E.L.C. and A.A. Lise. 2010. Two new species and new records of *Syntrechalea* (Araneae: Lycosoidea: Trechaleidae) from Brazil. *Zoologia* 27 (3): 408-412.

Silvestri, F. 1919. Contributions to a knowledge of the Chilopoda Geophilomorpha of India. *Record of the Indian Museum* 16: 45-107.

Souza, D.R.S. and A.B. Bonaldo. 2007. Revisão do gênero neotropical *Xeropigo* (Araneae, Corinnidae, Corinninae). *Iheringia* (Zool.) 97(3): 301-313.

Tourinho, A.L.M. and A.B. Kury. 1999. The first record of Schizomida for Rio de Janeiro and the first record of *Stenochrus* for Brazil (Arachnida, Schizomida, Hubbardiidae). *Boletim do Museu Nacional* 405: 1-6.

Villarreal-Manzanilla O. and R. Pinto-da-Rocha. 2006. Five new species of *Protimesius* from Brazil (Opiliones: Stygnidae). *Zootaxa* 1325: 219-233.

Received: June 2010
Revised: October 2010
Accepted: October 2010
Published online: November 2010
Editorial responsibility: Ana Lúcia Tourinho